

## BIBLIOGRAPHY.

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## EXPLANATION OF PLATE LXXV.

Fig. 1.	<i>Notops tofuana</i>	Rousselet,	dorsal view.	× 360.
2.	“	“	lateral view.	× 360.
3.	“	“	the jaws.	× about 700.

3. The Marine Fauna of the Mergui Archipelago, Lower Burma, collected by Jas. J. Simpson, M.A., B.Sc., and R. N. Rudmose-Brown, D.Sc., University of Aberdeen, February to May 1907.—The HYDROIDS. By JAMES RITCHIE, M.A., B.Sc., Natural History Department, The Royal Scottish Museum\*.

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(Plates LXXVI. & LXXVII.†, and Text-fig. 79.)

The Hydroids were represented in the collections brought together in the Mergui Archipelago by Dr. John Anderson in 1882, and described in the *Journal of the Linnean Society* for 1889, by a meagre total of six species, two of which were regarded by Hincks as new. The reasonable anticipation that the careful collecting of Dr. Brown and Mr. Simpson would add many species to the Hydroid fauna of this region of the Indian Ocean has been amply fulfilled; for the present collection, confined to a littoral area, contains representatives of thirty species, only three of which (*Campanularia varidentata* and *Idia pristis*, both widely distributed species, and *Aglaophenia crispata*, a synonym of *Lytocarpus pennarius*, *vide* Billard, 1909, p. 329) were included in Hincks's list.

As only two of the species, being described as new to science, must be regarded as peculiar to the Archipelago, the collection is well fitted to show the relationship which the Hydroid fauna bears to that of neighbouring seas. Leaving out of account an undetermined species of *Plumularia*, nineteen of the Mergui species have already been recorded from the Indian Ocean, the majority of these occurring off Madagascar and the eastern shores of Africa. The remaining ten species, indicated by

\* Communicated by R. KIRKPATRICK, F.Z.S.

† For explanation of the Plate; see p. 825.

asterisks in the following list, have thus been added to the fauna of the Indian Ocean. As to the wider relationships:— Three species are peculiar to the Indian Ocean (*Corydendrium sessile*, *Hebella crateroides*, *Calycella oligista*), leaving twenty-six to be accounted for. Of these, twelve are so widely distributed that their occurrence, emphasizing the normal nature of the fauna, can give no indication of special affinity: three being found in the Atlantic and North Pacific Oceans and in Australasian seas (*Opercularella lacerta*, *Plumularia setacea*, *Antenella secundaria*); two in the Atlantic and North Pacific Oceans (*Perigonimus repens*, *Campanularia crarilentata*); and seven in the Atlantic Ocean and in Malay-Australian seas (*Pennaria disticha*, *Halecium tenellum*, *Campanularia corrugata*, *Hebella calcarata*, *Sertularella polyzonias*, *Idia pristis*, *Diphasia digitalis*). Of the remaining fourteen, four have been found only in the Atlantic Ocean (*Eudendrium attenuatum*, *Cuspidella costata*, *Lafôea serrata*, *Lafôea venusta*), seven in the Malay-Australian area (*Eudendrium generalis*, *Cladocoryne haddoni*, *Halecium simplex*, *Thyroscyphus vitensis*, *Sertularella cylindrica*, *Sertularella quadriceps*, *Sertularia turbinata*), one in the North Pacific Ocean (*Thyroscyphus regularis*), and two in both the last-named areas (*Lytocarpus pennarius* and *L. phanicus*).

The closer relationship is obviously with the fauna of the Pacific Ocean (represented by ten distinctive species), and in particular with the Malay-Australian portion of that ocean (represented by seven species). The significance of the apparent Atlantic affinity is minimised when it is understood that of the four species common to it and the Mergui Archipelago, one (*Eudendrium attenuatum*) is identified with much doubt, while the remaining three are very minute epizoid species, the presence of which in other regions may conceivably have been overlooked.

It is remarkable that of the thirty species recorded, seventeen were found climbing upon larger Hydroids and one upon a Polyzoon, the majority being minute, habitual epizoids, belonging in the main to the families Halecidae, Campanularidae, Campanulinidae, and Lafôeidae. The examination of this collection, and of others, leaves with me the distinct impression that the epizoid Hydroids are not distributed indiscriminately upon all types of Hydroid host. Thus, in general, the members of the family Plumularidae remain comparatively free from extraneous growths—a fact to be correlated, perhaps, with their possession of nematophores; while colonies, belonging especially to the family Sertularidae, are occasionally so overgrown that the structures of the host are much obscured. Even distinct preferences for certain species may be observed. Taking, for each epizoid species in this collection, the total numbers of stations at which it was found, and adding those numbers for all the epizoid species, we find that epizoid species were found at a sum total of forty-five stations. At thirty-two of these *Idia pristis* was either the only host, or one of the hosts where more than one species

was infested; *Thyroscyphus vitiensis* at nine; *Sertularella quadridens* at four; *Corydendrium sessile*, *Eudendrium attenuatum*, *Lytocarpus phoeniceus* each at two; and *Diphasia digitalis* and *Plumularia setacea* each at one. This result bears out the impression gained from handling the collection, that *Idia pristis* is remarkably subject to infestation by extraneous Hydroid colonies. Frequently its hydrothecae were all but obscured by the attendant growths of Hydroids and Polyzoa, and this although the state of the hydranths and of the coenosarc generally, indicated that the host colony was in a perfectly healthy condition.

The occurrence, in *Lafoëa venusta* (?), of what appears to be a step towards a more intimate symbiosis; of a canaliculated coenosarc in the stem and branches of *Sertularella quadridens*; of the hitherto undescribed gonosomes of *Halecium simplex* and *Thyroscyphus regularis*, are worthy of notice.

Finally, I would express my thanks to Dr. R. N. Rudmose-Brown and Mr. J. J. Simpson for entrusting this collection to me for examination.

### *List of Species.*

#### I. Gymnoblastera.

##### Family CLAVIDÆ.

\**Corydendrium sessile*, sp. n., p. 802.

##### Family BOUGAINVILLIDÆ.

\**Perigonimus repens* Wright, p. 804.

##### Family EUDENDRIDÆ.

\**Eudendrium attenuatum* Allman (?), p. 804.

\* " *generalis* Lendenfeld, p. 805.

##### Family CORYNIDÆ.

*Cladocoryne haddoni* Kirkpatrick, p. 805.

##### Family PENNARIDÆ.

*Pennaria disticha* Goldfuss, var. *australis* Bale, p. 806.

#### II. Calyptoblastera.

##### Family HALECIDÆ.

\**Halecium simplex* Pictet, p. 807.

" *tenellum* Hincks (?), p. 808.

##### Family CAMPANULARIDÆ.

*Campanularia corrugata* Thornely, p. 809.

" *raridentata* Alder, p. 809.

*Hebella calcarata* A. Agassiz, p. 810.

" *crateroides* Ritchie, p. 810.

*Thyroscyphus regularis* Jäderholm, p. 811.

" *vitiensis* Marktanner, p. 812.

## Family CAMPANULINIDÆ.

\* *Opercularella lacerta* Johnston, p. 812.

\* *Calycella oligista*, sp. n., p. 813.

*Cuspidella costata*, Hincks, p. 814.

## Family LAFOËIDÆ.

*Lajoča serrata* Clarke, p. 815.

\* „ *venusta* Allman (?), p. 815.

## Family SERTULARIDÆ.

\* *Sertularella cylindrica* Bale, var. *pusilla*, n., p. 817.

„ *polyzonias* L., var. *corunta* Ritchie(?), p. 818.

\* „ *quadridens* Bale, p. 818.

*Idia pristis* Lamouroux, p. 820.

*Diphasia digitalis* Busk, p. 821.

*Sertularia turbinata* Lamouroux, p. 821.

## Family PLUMULARIDÆ.

*Plumularia setacea* Linn. (?), p. 822.

„ sp. indet., p. 822.

*Antenella secundaria* Gmelin, p. 822.

*Lytocarpus peanarius* Linn., p. 822.

„ *phœnicus* Busk, p. 823.

\* indicates a species recorded for the first time from the Indian Ocean.

## SYSTEMATIC DISCUSSION.

## 1. GYMNOBLASTEÆ.

## Family CLAVIDÆ.

*CORYDENDRUM* SESSILE, sp. n. (Plate LXXVI. figs. 1 & 2.)

TROPHOSOME.—Colony small, the largest of the three collected being only 37 mm. in height. The stem is strongly fascicled, 1.5 mm. thick towards the base, and straight. It may divide into main branches, which are beset by numerous smaller, almost equal branchlets, about 1 mm. in length. These spring from two opposite sides, and lie roughly in one plane. The branchlets on any one side are almost equidistant from each other, but their positions bear no regular relation to those of the opposing series. They taper very slightly towards the base, but there is no trace of ringing nor of wrinkling.

The majority of the hydranths spring from tubes on the anterior surface of the branchlets, although a few are also scattered on the main branches. The hydranth tubes do not become free from the common fascicle, except rarely and for an extremely short distance; nor are special hydrophore-like portions developed. Thus the hydranth projects simply from the open mouth of a tube, the adcauline wall of which is adnate. The hydranth tubes

are arranged in two series, the polyps of one series alternating with those of the other. The aperture faces outwards and upwards, is slightly elliptical in shape, and has an even margin, indicating the boundary between the thicker perisarc and the place where the chitinous coat becomes so thin and delicate that it follows the movements of the polyp. The perisarc throughout is covered by a thin coating of extraneous material—diatoms, sand-grains, fragments of sponge-spicules, and such like.

The hydranths are much contracted, and in this state exhibit a pyriform body with well-developed hypostome. The tentacles appear to number about forty.

GOXOSOME unobserved.

Colour, in alcohol, grey.

Dimensions :—

Diameter of branchlets immediately above origin	0.31–0.38 mm.
„ hydranth tube .....	0.25–0.31 mm.
Hydranth, length .....	0.52–0.98 mm.
„ diameter .....	0.21–0.42 mm.
Nematocysts on tentacles, length .....	5 $\mu$ .
„ „ breadth .....	3 $\mu$ .

*Locality.* Three small colonies, with hydrorhiza embedded in a sponge, were found at St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand.

So little is known of the variation liable to occur in the individual species of this genus, that it is difficult to fix on definite specific characters. In this case, I have relied mainly on the structure of the tubes from which the hydranths project. In the majority of the species of *Corydendrium* so far described these are free for a considerable distance below the hydranth: but here the tubes are adnate up to the end. This gives to the branches a dumpy appearance, unlike the lax growth of other species. In this respect it approaches most closely *C. corrugatum* Nutting (1905, p. 941), which is to be distinguished, however, by its distinct “hydrophore-like structures,” which are “usually distinctly corrugated with deep irregular annulations”; by the presence of a well marked annular constriction near the origin of the branches: and by the large size (5 inches) of the colonies.

The species, *Soleniopsis dendriformis*, described by me in 1907 (1907, p. 494) as representing a new genus, under the erroneous supposition that *Corydendrium* gave rise to gonophores with free medusæ—I had been unable to refer to the magnificent description of Weismann (1883),—obviously belongs to the genus *Corydendrium*, as Dr. Stechow has recently pointed out (1909, p. 9).

*Corydendrium dendriformis* differs from *C. parasiticum* in possessing thick, definite stems, with branchlets arranged in pseudo-pinnate fashion, and in having the free portion of the tubes from which the hydranths project much shorter than those of *C. parasiticum*.

## Family BOUGAINVILLIDÆ.

## PERIGONIMUS REPENS Wright, 1858.

Rare examples of an epizoic species occur, which cannot be specifically distinguished from British specimens of *P. repens*, the simple lax habit of which they exactly assume. There are differences between the dimensions of the Mergui and of British examples; for while the former are smaller in height and in the proportions of their hydranths and hydrocaulus, in respect of the nematocysts in the tentacles the order is reversed. The comparative table which follows shows at a glance the size-relations of the two forms. About twelve tentacles crown each hydranth.

No trace of gonosome was observed.

Dimensions :—	Mergui specimen.	Typical Scottish example*.
Height of colony .....	3 mm.	6 mm.
Diameter of hydrocaulus .....	0.04 mm.	0.07 mm.
Hydranth, length .....	0.17–0.24 mm.	0.24–0.34 mm.
„ greatest breadth .....	0.08–0.13 mm.	0.14–0.15 mm.
Nematocysts of tentacles, length	5.5 $\mu$ .	4.5 $\mu$ .
„ „ breadth	3 $\mu$ .	2.2 $\mu$ .

*Locality.* Rare colonies epizoic on *Corydendrium sessile*, from St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand.

The present record adds *P. repens* to the fauna of the Indian Ocean. It has already been noted from the eastern and western sides of the North, and the western side of the South Atlantic Ocean, from the Mediterranean Sea, and from the eastern and western (Japan: Stechow, 1909, p. 25) sides of the Pacific Ocean.

## Family EUDENDRIDÆ.

## EUDENDRIUM ATTENUATUM Allman (?), 1877.

Many poor colonies, lacking any trace of hydranth or gonosome, I refer, with uncertainty, to this species, on account of resemblance in the skeleton. The Mergui specimens attain a somewhat greater length (3 inches) than the original examples; but the delicate, very slender, non-fascieled stems, with their few branches, and their short hydranth-bearing ramules lying in one plane and set alternately at regular intervals of about 1 mm., are very similar in both cases. Three or four rather irregular annulations mark the base of each ramule, and occasionally a few odd rings occur irregularly on the ramules and on the stem itself. The regular and close alternation of the hydranth-bearing ramules seems the most evident character of an indefinite species, though a somewhat similar arrangement is observed in *E. maldivense* Borradaile (1905, p. 838).

\* Slide of specimen from Loch Carron, 60 fathoms, in my collection.

Dimensions:—

Stem, diameter ..... 0·20–0·24 mm.  
Hydranth-bearing ramules, diameter . 0·11–0·16 mm.

*Localities.* Many colonies from St. 22, Hastings Harbour, 3 to 20 fathoms and shore, rock and sand; and a few poor colonies, paler in colour, from each of Stations 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; and 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock.

Recorded originally by Allman from S.S.W. of Tortugas, at a depth of 60 fathoms, this doubtful species forms an addition to the fauna of Indian seas.

*EUDENDRIUM GENERALIS* Lendenfeld, 1885.

The colonies belonging to this species are mature, but are only about 1 cm. in height. They bear well-developed female gonophores, oval in shape, which spring in a whorl of four or five from the base of a hydranth, as in Kirkpatrick's description and figures (1890, p. 607, pl. xv. fig. 2).

The trophosome of this species is hard to distinguish from that of *E. capillare*. The more slender character of the branches of the latter, relied on in part by Kirkpatrick, is of little value, since a considerable amount of variation occurs in both species. On the other hand, the branching of *E. capillare* is more profuse, and irregular; also in the Australian species there is, in the smaller branches, distinct alternation, while the whole colony appears more rigid than the lax growths of *E. capillare*.

Dimensions:—

Stem, diameter ..... 0·14 mm.  
Hydranth-bearing ramule, diameter ..... 0·09 mm.

*Locality.* Creeping in small quantity upon *Eudendrium attenuatum*? and *Idia pristis*, both from St. 22, Hastings Harbour, 3 to 20 fathoms and shore, rock and sand.

Until the present record from the Indian Ocean, this species has been found only in the Australian region: Port Phillip, near low water (Lendenfeld, 1885, p. 351); Torres Straits—20 miles N.N.W. of Warrior Island, 5½ fathoms; Murray Island, 15 to 20 fathoms (Kirkpatrick, 1890, p. 607).

#### Family CORYNIDÆ.

*GLADOCORYNE HADDONI* Kirkpatrick, 1890.

Except in size (for they are even more diminutive than those recorded by Kirkpatrick and Jäderholm), the Mergui specimens agree with the description and figures of the former, the double wrinkle at the base of the stalk being very evident. On occasion, one or two additional wrinkles may occur at the base of the stalks and, more seldom, on their middle portions; but in the majority of cases these rings are of little significance, since they belong to a new stalk regenerated after the destruction of the old one. Here,

as in simple Campanularian hydroids, regeneration is not content with simply adding a portion to the old stalk, but a complete new stalk is reproduced, springing from within the truncated end of the old one.

Dimensions :—

Stalk, length .....	0.43-0.98 mm.
„ diameter .....	0.06-0.08 mm.
Stolon, diameter .....	0.10 mm.
Hydranth, length.....	0.34-0.36 mm.
„ greatest breadth .....	0.11-0.21 mm.

Cnidoblast threads, armed with barbs such as Kirkpatrick has figured, accompany several of the hydranths. They are remarkable for their large size, the barbed portion being  $6\ \mu$  in diameter from tip to tip of the barbs.

*Localities.* Rare hydranths on *Thyroscyphus vitiensis* and on *Idia pristis* from St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud. A solitary hydranth on *Idia pristis* and a few on *Corydendrium sessile* from St. 35, between Warden Island, Howe Island, and Lyaal Island, 15 to 20 fathoms, rock and sand.

The species has been previously recorded only from Murray Island, Torres Straits, 15 to 20 fathoms (Kirkpatrick, 1890, p. 606); and, in Indian seas, from Paumben, 1 to 3 fathoms (Jüderholm, 1903, p. 263).

#### Family PENNARIDÆ.

\* PENNARIA DISTICHA Goldfuss, 1820. Var. AUSTRALIS Bale, 1884.

(= *Pennaria carolinii* Ehrenberg, 1832.)

A few well preserved colonies, the largest 30 mm. high, represent this species. The ramules from which the hydranths project increase considerably in diameter upwards from their origin, where they bear three or four annulations, to the distal end, which is smooth. The number of filiform tentacles varies from nine to twelve, but there is much variation in the number of the capitate tentacles. The numbers depend, to some extent, upon the age of the hydranth, for the tentacles are fewest in those hydranths which, springing from ramules, lie towards the distal end of a branch—that is, in the youngest hydranths; for growth proceeds by the elongation of a branch, new polyps coming into being next to the terminal polyp, which is the oldest and the largest on the branch.

Pictet's careful comparative study of colonies of typical *P. carolinii* from Naples, and of typical *P. australis* from Amboyna, makes clear that the latter form falls within the range of variation observed in the former species. But so definitely limited is the basal ringing of the ramules from which the hydranths arise, and so great a difference is there

\* For synonymy, see Bedot, 1901, p. 459.



in the proportions of the European and the Indo-Pacific forms, that I retain for the latter a distinct varietal name.

*Locality.* St. 29, reef off High Peaked Island, shore.

Although *P. carolinii* in its varying forms has been recorded from Eastern Australia (Bale, 1884, 1893; Lendenfeld, 1885), and from the East Indies (Pictet, 1893; Campenhausen, 1896; Weltner, 1900), the only records for the Indian Ocean are those of Warren (1906, 1907, and 1908, as *Halocordyle cooperi*, syn. *Pennaria australis*, var. *cooperi*) and that from Christmas Island in the paper following.

## II. CALYPTOBLASTEA.

### Family HALECIDÆ.

HALECIUM SIMPLEX Pictet, 1893. (Plate LXXVII. figs. 10 & 11.)

This very rare species is represented by closely woven colonies covering the surface of a Polyzoon which is clustered at the base of colonies of *Corydendrium sessile*. The presence of the gonosome, so far undescribed, renders these specimens of particular interest.

TROPHOSOME.—To the naked eye the minute colonies are almost invisible, the hydranths being most easily discerned as they project from the surface on which the colonies grow, in close groups, resembling clusters of the smaller species of the entoproctan polyzoon, *Pedicellina*.

The stolon strands are of small diameter, but can often be traced for a considerable distance. Their courses are complicated, however, by the occurrence of offshoots, which, uniting with other stolons, form a network which lies closely upon the substratum, or is interwoven with it.

Short, unbranched, unwrinkled hydrocauli arise from the stolon at short distances from each other. Basally their diameter is small, but it gradually increases until, at the base of the hydrotheca, the girth of the hydrocaulus is about equal to that of the stolon. The hydrothecæ are very small. Their walls, which are well developed, form an inward curve to the margin, so that, instead of being flaring or trumpet-shaped, as in many species of *Halecium*, they are rather saucer-shaped. Very close to the margin occurs a ring of bright dots, chitinous prominences on the inner surface of the hydrotheca to which the hydranth is attached. Here the internal prominences are more highly developed than in any other species I have examined, for they sometimes rise into pronounced spines  $7\ \mu$  in length (Pl. LXXVII. fig. 11). Occasionally two or even three hydrothecæ occur in succession, a new hydrocaulus arising from within an old hydrotheca.

The hydranth is of great size. When contracted it is about twice as long as the hydrocaulus, but when extended it reaches a length of one millimetre or even more. It consists of a long

cylindrical neck, the base of which is attached to the hydrotheca at the chitinous projections already described. Distally this swells out into a very definite bulb, which is surmounted by a circle of from 18 to 20 tentacles. At the bases of the tentacles a ring of very large bean-shaped nematocysts, 30  $\mu$  long by 6  $\mu$  broad, surrounds the hydranth. Similar cells occur in the cenosare of hydrocaulus and stolon.

**GONOSOME.**—This does not appear to have been described. A gonangium arises from the side of the hydrocaulus, about half-way between the hydrotheca and the stolon. The female gonangium is borne on a short stalk, and is roughly calceolate in shape, resembling the female gonangium of *H. beanii*, except that here the tubular orifice of the upper surface does not occur. All the gonangia I have examined contain ova to the number of about six. The male gonangium, therefore, remains unknown.

Dimensions :—

Stolon, diameter .....	0.06–0.07 mm.
Hydrocaulus, length .....	0.18–0.28 mm.
Hydrotheca, depth .....	0.024–0.027 mm.
„ diameter at margin .....	0.08–0.10 mm.
Gonangium, length .....	0.42–0.50 mm.
„ greatest diameter .....	0.17–0.21 mm.
Hydranth, length extended .....	1.05 mm.
„ „ contracted .....	0.78 mm.

*Locality.* Epizoeic on a polyzoon associated with *Corylendrium sessile*, from St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand.

Hitherto recorded only from Amboyna, in the Moluccas (Pictet, 1893, p. 22), this record adds the species to the fauna of Indian seas.

#### HALECIUM TENELLUM Hincks (?), 1861.

The trophosomes are lax in habit, and in all other respects agree with Hincks's species; but, in the absence of the gonosome, confident identification is impossible, especially since the likeness between the trophosomes of young examples of the Australian *H. parvulum* Bale and *H. tenellum* appears to be almost perfect (see Markt.-Turner., 1890, p. 218).

Dimensions :—

Stem, diameter .....	0.045 mm.
Hydrotheca, depth .....	0.024–0.030 mm.
„ diameter at margin .....	0.099–0.108 mm.

The dimensions of the Mergui specimens are considerably smaller than those of British examples.

*Localities.* Epizoeic on *Thyroscyphus rutilensis* from Stations 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud.

Recorded with some doubt from Eastern Australia by Bale (1884, p. 65) and Lendenfeld (1885, p. 405), this widely dis-

tributed species has been described from the Indian Ocean only by Billard, from Macalonga, Mozambique, 22 metres (1907 *b.* p. 338).

Family CAMPANULARIDÆ.

CAMPANULARIA CORRUGATA Thornely.

Except at Station 1, where it was also associated with *Sertularella quadridens* and *Diphasia digitalis*, this species always occurred as an epizoon on *Idia pristis*.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; short and stout, strongly ribbed hydrothecæ on *Diphasia digitalis*, and long, cylindrical individuals on *Idia pristis*. Stt. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; occasionally. St. 22, Hastings Harbour, shore to 20 fathoms, rock and sand; fairly common. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; not common. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells and rock; rare cylindrical hydrothecæ with short stalks. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; rare.

CAMPANULARIA RARIDENTATA Alder, 1857.

From British examples the majority of the specimens here referred to *C. raridentata* differ in lacking the swelling which intervenes between the base of the stalk and the stolon, in this respect resembling examples recorded from areas so wide apart as Calbuco, South America (Hartlaub, 1905, p. 567), St. Malo, France (Markt-Turner., 1890, p. 205), and the Indian Ocean (Hincks, 1889, p. 133, *cf.* pl. xii. fig. 5). From seven to eleven rings occur at the base of the stem, and from three to five underneath the hydrotheca, and sometimes a few annulations mark also the middle portion of the stem. The margin of the hydrotheca appears to be divided into from five to seven large teeth, the extreme tenuity and transparency of which render them difficult to observe. The hydranth bears twelve to thirteen tentacles.

No gonosome was observed.

The dimensions of the Mergui specimens are much less than those of St. Malo specimens recorded by Marktanner-Turneretscher (1890, p. 205), and approach most closely those of a single example from Saint-Vaast described by Billard (1907 *a.* p. 173), with which they also agree in possessing few hydrothecal teeth.

Dimensions, in mm. :—

	St. 1.	St. 23.
Stem, length .....	0.59	0.35-0.45
„ diameter .....	0.07	0.04-0.06
Hydrotheca, depth .....	0.50	0.29-0.41
„ diameter at mouth .....	0.17	0.13-0.15

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4-12 fathoms, sand and broken shells, and mud; rare. St. 25, Five Islands, 8 to 12 fathoms, rock and sand, and mud; rare. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; rare.

Except from St. 23, where this species also occurs on *Sertularella quadridens*, specimens are confined to *Idia pristis*.

From each of Stations 1 and 28 comes a solitary simply-stalked hydrotheca with cone-shaped basal portion, surmounted by almost cylindrical walls terminating in seven or eight sharp teeth. The structure of the basal portion resembles that of the hydrotheca of *Obelia andersoni* Hincks, but I regard the present specimens as abnormally developed examples of *C. raridentata*.

#### HEBELLA CALCARATA A. Agassiz, 1865.

One of the most widely distributed of the species in the collection, occurring at eight of the fourteen stations from which Hydroids were obtained. It shows considerable diversity of form, being usually represented by the long smooth hydrothecæ of the typical form, but frequently assuming the shape of the variety recorded by Marktanner (1890) as *Lafœa contorta*. This epizoic species, like several others, shows a remarkable constancy of preference for *Idia pristis*, seeing that at all stations, with the exception of Station 9, where it was creeping on *Thyroscyphus vitiensis*, it occurred on that species, and on it alone.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; not common, often var. *contorta*. St. 9, between Bentinek Island and Courts Island, 12 to 26 fathoms, sand and shells. St. 14, Bushby Island pearling-ground, shore to 21 fathoms, sand and mud; rare. St. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; occasionally present, often assuming the shape of var. *contorta*. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; very common, mostly var. *contorta*. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock; very rare. Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; common.

#### HEBELLA CRATEROIDES Ritchie, 1909 b.

The hydrothecæ are smaller than those of the type specimens from the Andaman Islands. The hydranths are decayed, and no gonosome was observed.

Dimensions:—

Hydrotheca, depth .....	0.20 mm.
„ diameter at mouth .....	0.15-0.17 mm.

*Localities.* St. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; rare, on *Lytocarpus plumierus*.

THYROSCYPHUS REGULARIS Jäderholm, 1896. (Plate LXXVII, fig. 7.)

(*T. aqualis* Warren, 1908.)

TROPHOSOME. The specimens are somewhat larger than those originally described, sometimes almost 20 cm. in length, while the branches may reach a length of 45 mm., in place of the maximum of 18 mm. given by Jäderholm.

The species is readily distinguished from *T. vitiensis* by the presence of a very distinct operculum, accompanied by deep bays round the margin; further, the bright rim runs in this case much nearer to the edge, and is not so pronounced, while the faint ringing at the internodes is more marked. The joints, varying in number, which are said to occur on the peduncle, are only occasionally present (though sometimes up to three or four were observed), and even then they are not essential to the specific structure, for they are due to the destruction of the hydrotheca, and to the subsequent regeneration of a new hydrotheca from within the remains of the old one, the apparent joints being the reliquæ of former calyces. No specific value can attach to these accidental "joints," the like of which I have already observed in *Thyroscyphus simplex* = *tridentatus* (1909, p. 75, fig. 1 b) and in *Lytoscyphus marginatus*; but in *T. ramosus* the semblance of a twist occurs in the peduncle.

The minute structure of the cœnosarc is obscured by the presence of opaque granules which occur in great abundance. In these specimens the hydranth is attached, not to a continuous ridge, as in the specimens from Natal, which Warren has described as *T. aqualis* (and which I am unable to distinguish from *T. regularis*), but to a row of small chitinous prominences which runs round the inside of the hydrotheca in an exceedingly sinuous curve, having two maxima, one on the adcauline, the other on the abcauline surface, and two lateral minima.

GONOSOME. Gonangia, which have not previously been described, were found on a single colony from Station 25 (Pl. LXXVII, fig. 7). The cœnosarc has disappeared, but the perisarc is in the form of a long cylinder, larger even than that of *T. torresii* (see Jäderholm, 1903, p. 273). Very indefinite and irregular wrinkles appear on the perisarc. The insignificant stalk of the gonangium arises from the projection of the internode upon which a hydrotheca is perched

Dimensions:—

Branch, diameter .....	0.36 mm.
Distance between hydrothecæ .....	1.13 to 1.3 mm.
Hydrotheca, depth .....	0.96 mm.
"    breadth at mouth .....	0.63 mm.
Peduncle, diameter.....	0.20 mm.
Gonangium, length.....	3 mm.
"    breadth .....	1 mm.

*Localities.* A large bunch of colonies from St. 22, Hastings

Harbour, shore to 20 fathoms, rock and sand. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; two colonies. St. 25, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; many colonies.

This species has already been recorded from the China Sea (Jäderholm, 1896, p. 9), and from Bird Island, Algoa Bay, Cape Colony (Warren, 1908, p. 344, as *T. aequalis*).

*THYROSCYPHIUS VITIENSIS* Marktanner-Turneretscher, 1890.

A widely distributed species, occurring at eight of the fourteen stations from which Hydroids were obtained. In this, as in *T. regularis*, the hydranth is attached to a row of minute chitinous prominences on the inside of the lower portion of the hydrotheca. These are arranged as in the previous species, but they are more strongly developed, and are placed on a slightly raised portion of the hydrothecal wall.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; common. St. 3, French Bay, King Island, and south end of Iron Island, 3 to 8 fathoms, mud and rock, or sand; common. St. 9, between Bentinek Island and Courts Island, 12 to 26 fathoms, sand and shells; rare. St. 14, Bushby Island pearling-ground, shore to 21 fathoms, sand and mud; rare. Sts. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; rare. St. 19, Paye Island and Pink Island, 7 to 9 fathoms, rock and sand; rare. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock; fairly common. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; rare.

Family CAMPANULINIDÆ.

*OPERCULARELLA LACERTA* Johnston, 1847.

Identification depends upon trophosome characters alone, the gonosome being absent. I can detect nothing, however, which could distinguish these specimens from North Sea examples of the above species. It occurs in its simplest form, a creeping stolon, sending up here and there short ringed stalks, on each of which is poised an exceedingly hyaline hydrotheca.

Dimensions:—

Hydrotheca, depth *	0.21 mm.
,,    diameter	0.08-0.09 mm.
Peduncle, diameter	0.04 mm.

*Locality.* Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; rare, growing on a stem of *Plumularia setacea*.

Although the range of the species is a wide one, for it has been recorded from the North of Europe, from both sides of the

\* From top of operculum.

North Atlantic Ocean, and from the Western Pacific (China and Eastern Australia), it has not hitherto been found in the Indian Ocean.

CALYCELLA OLIGISTA \*, sp. n. (Plate LXXVI. figs. 3 & 4.)

TROPHOSOME. The colony is epizoic, and consists of a creeping, delicate stolon which lies in close contact with the specimen upon which it occurs. From this stolon hydrothecæ spring at irregular intervals.

The hydrothecæ are exceedingly minute, delicate, hyaline, and transparent, without a trace of the smoky tint which characterises *C. syringa*. In shape they are tubular and cylindrical, of approximately the same diameter for the greater portion of their length, although the proximal half is usually slightly bulged, and tapers, more or less rapidly, to join the stalk. The margin of the hydrotheca, which is very slightly everted, is definite, and is of considerable strength, for it is seldom that it is found in a collapsed condition. It is divided into shallow crenulations, similar to those in *C. syringa*, each of which subtends the base of an opercular valve. In no case was a duplication of the margin noticed. The operculum is distinct from the hydrothecal wall, and is composed of about twelve to fourteen exceedingly delicate valves, difficult to distinguish. The cavity of the hydrotheca is separated from that of the stalk by a distinct but delicate diaphragm. The stalk is usually very short, so that the hydrotheca almost rests on the stolon, but in one case (Pl. LXXVI. fig. 3) a well developed stalk was observed. This stalk was marked by a few irregular indentations, but in other cases the stalks were smooth, and ringing of a regular nature never occurred.

The hydranth is large compared with the size of the hydrotheca. It is attached by a basal disk to the hydrothecal wall immediately above the diaphragm, and is continued upwards as a cylindrical body with conical hypostome, surrounded by a whorl of about seven to ten tentacles. The ectoderm is thick, and the tentacles, in contraction, are dumpy and stout.

The gonosome was not observed.

Dimensions:—

Stolon, diameter .....	30 $\mu$ .
Hydrotheca, depth .....	120–138 $\mu$ .
„ greatest diameter .....	45–66 $\mu$ .

*Localities.* St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; very rare, on *Idia pristis*. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; very rare, on *Idia pristis* and *Thyroscyphus vitiensis*.

*Systematic position.*—This species differs remarkably in size, colour, texture, and in the development of the peduncle and its ringing from *C. syringa*, although there is a similarity between

\*  $\delta\lambda\gamma\iota\sigma\tau\omicron\varsigma$ , smallest.

its hydrotheca and some of the varieties of the latter species (see Broch, 1909 *b*, text-fig. 22). It approaches most closely *C. nuttingi* Hargitt (1909, p. 378), from which it differs in being smaller in size, in being cylindrical instead of tapering from hydrothecal margin to base, and in lacking distinctly annulated peduncles, with "annulations occasionally extending some distance (rarely over the entire body) on the thecal walls."

I regard the unnamed specimen, mentioned and figured by Miss Thornely (1908, p. 83, pl. ix, fig. 5), from Khor Shinab, 10 to 12 fathoms, in the Soudanese Red Sea, as belonging to this species.

CUSPIDELLA COSTATA Hincks, 1868. (Plate LXXVII, fig. 8.)

To the short and incomplete description given by Hincks the following observations may be added. The hydrotheca is cylindrical for the greater part of its length, but near the base it gradually tapers downwards. Frequently the basal portion of the hydrotheca lies along the object upon which the epizoon is growing, the distal portion bending upwards at an angle, slightly after the manner of *Laföëa serrata*. Within the bent portion the retracted polyp is generally found. Similar bent hydrotheca have been described by Dr. Billard from La Hougue (1904, p. 165).

The lines of growth held to be characteristic of the species, and clearly marked in our specimens, are not lines of growth in the ordinary sense, marking the place where new growth has commenced. They indicate, instead, the margins of earlier hydrotheca, the opercular flaps of which occasionally remain attached and give an appearance of longitudinal fluting to the succeeding portion of the hydrotheca, as is suggested in the terminal segment in Hincks's figures (1868, pl. xl, figs. 5, 5 *a*). The secondary hydrotheca (produced probably on the regeneration of an entirely new hydranth) lies within the primary, and for some distance their walls, though in close contact, remain distinct. The tertiary, when such occurs, lies within the secondary, and so on. Thus the terminal segment is, as Hincks observes, "of thinner material than the rest," for its walls are those of a single hydrotheca, while proximal to the uppermost segment the walls, owing to the telescoping arrangement, are considerably strengthened. It is noteworthy that the proximal segment is usually of distinctly less calibre than its successors. The operculum of the hydrotheca is composed of about 14 or 15 flaps.

The hydranth is strongly retractile, retiring on contraction to the proximal third of the hydrotheca. It appears to have about six to eight tentacles, which are closely set with whorls of large oval nematocysts, the whorls being  $7.5 \mu$  apart. The average size of the nematocysts in these whorls is  $5.2 \mu$  long by  $2 \mu$  broad, but at the tip of the tentacle larger examples occur,  $10.5 \mu$  long by  $5 \mu$  broad.

No gonosome was observed.



Dimensions:—

Hydrotheca, length .....	0·7–1·12 mm.
"    diameter .....	0·10–0·14 mm.
Length of flaps of operculum .....	0·11–0·13 mm.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; rare hydrothecae on *Thyroscyphus vitiensis*. St. 3, French Bay, King Island, and south end of Iron Island, 3 to 8 fathoms, mud and rock, or sand; very rare, on *Thyroscyphus vitiensis*.

#### Family LAFOËIDÆ.

LAFOËA SERRATA Clarke, 1879.

A widely distributed, but moderately rare species. Repeated regeneration of the hydranth had furnished one hydrotheca (from St. 22) with the exceptionally large number of eleven successive margins.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; fairly common, on *Idia pristis*. St. 9, between Bentinck Island and Courts Island, 12 to 26 fathoms, sand and shell; very rare, on *Thyroscyphus vitiensis*. Stts. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; rare, on *Idia pristis*. St. 22, Hastings Harbour, shore to 20 fathoms, rock and sand; fairly common, on *Thyroscyphus vitiensis* and *Idia pristis*. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; rare, on *Eudendrium attenuatum?* St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock; rare, on *Idia pristis*. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; rare, on *Idia pristis*.

LAFOËA VENUSTA Allman (?), 1877. (Plate LXXVI. figs. 5 & 6.)

Various Hydroids have associated with them a small form which I refer, with a query, to this species.

The trophosome consists of a creeping hydrorhiza from which spring small cylindrical hydrothecae, set on stout but variable stalks, and zoned by numerous, well-defined, and regular corrugations. These decrease in distinctness towards the base of the hydrotheca. The margin of the hydrotheca is everted, and the stalk bears no regular rings. A marked and distinctive character exists in the colour of the perisarc which possesses a brownish-smoke tint, slightly variable in density. An exceedingly delicate membrane forms the floor of the hydrotheca.

The hydranth is cylindrical and minute, furnished with a hemispherical hypostome, surrounded by tentacles varying in number from nine to eleven. The tentacles and body of the hydranth have a granular appearance owing to the presence of scattered nematocysts, which do not seem, even in the tentacles,

to be arranged in whorls, and of large, deeply stainable cells in the body-wall.

The habit of this epizoon is peculiar, for, in addition to the ordinary external meandering, the cœnosarc may live within the perisarc tube of the hydroid upon which it grows. Thus in several cases, the hydrothecæ of this species project from within the hydrothecæ of *Idia pristis* and *Sertularella quadridens*. In this respect much resemblance is shown to the habit of *Lafôia dispolians*, Warren (1909, p. 105), the wanderings of which within the perisarc of its host, *Sertularia bidens* Bale, have been closely traced by Dr. Warren. In the present case the material being in a poor state of preservation, I have been unable to trace the course of the parasite throughout.

Dimensions:—

Hydrotheca, length.....	0.53-0.84 mm.
„ greatest diameter.....	0.21-0.27 mm.
Peduncle, diameter.....	0.075-0.081 mm.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; solitary hydrothecæ on *Idia pristis* and *Sertularella quadridens*. St. 14, Bushby Island pearling-ground, shore to 21 fathoms, sand and mud; rare, on *Idia pristis*. St. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; very rare, on *Idia pristis*. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; very rare, on *Sertularella quadridens*.

Hitherto this species has been found only on the western sea-board of the North Atlantic Ocean, and growing upon only one host, *Lytoscyphus marginatus* Allman: Loggerhead Key, 9 fathoms (Allman, 1877), 10 miles north of Zoblos Island (Clarke, 1879), Anguilla, Antilles, 100-150 fathoms (Jäderholm, 1903), off Bermuda, 30 fathoms (Ritchie, 1909 *a*), and Prof. S. F. Clarke, *in litteris* 1909, mentions its occurrence at West Florida, 20 fathoms, again on *Lytoscyphus marginatus*.

*Systematic position.*—The general appearance of the specimens described as *Lafôia venusta* resembles that of a small parallel-sided form of the exceedingly variable *Campanularia corrugata* Thornely. As the gonosomes of both species are unknown, and even the hydranth of the former is undescribed, the difficulties of identification are thus greatly increased. The present specimens are, however, specifically distinct from *Campanularia corrugata*, on account of the much smaller size of their hydrothecæ, which are also more regularly ringed, and are always cylindrical in shape. The hydranths also differ in shape and in structure. Those of the present specimens are more slender and possess 9 to 11, in place of 22 tentacles; they have a more hemispherical hypostome, and lack the peculiar development of those endodermal cells, which, in *C. corrugata*, project from the base of the tentacles into the gastric cavity, almost meeting there below the

hypostome, and reminding one of the structure of *Bonneriella grandis*, described by Broch (1909 *a*, p. 195). I have not noticed that in Miss Thornely's species the perisarc is tinged with brown.

To *Lajoëa venusta* I have, with a little doubt, referred my specimens because of the shape, the small size, and the corrugated walls of the hydrothecæ.

#### Family SERTULARIDÆ.

SERTULARELLA CYLINDRICA Bale, 1888. Var. PUSILLA, nov. (Plate LXXVII. fig. 9.)

Simple stems spring from a creeping stolon, and these are divided into internodes of exceeding variable length by slightly slanting nodes. At the distal end of each internode a hydrotheca is borne.

The hydrothecæ are alternate, and have very thin, collapsable walls, in strong contrast with the thick internodal perisarc. In comparison with the stem upon which they are carried, the hydrothecæ are very large. In shape they are cylindrical, the cylinder expanding slightly at the mouth and forming an everted margin, entire, and destitute of operculum. For about a third of their length they are adnate to the internode, but beyond this their free portion curves gracefully away from the stem, so that the aperture faces upwards and outwards, the plane in which it lies meeting the stem at an angle of about 45°. A slight break in the even abcauline profile of the hydrotheca opposes the point where the adcauline side becomes free from the stem. Often the bottom of the hydrotheca is rounded. Stolons are occasionally developed from the stems, and one was observed springing from the inside of a hydrotheca.

Gonosome unknown.

Dimensions:—

	Var. <i>pusilla</i> .	Typical form.*
Internodes, length .....	0·27-0·36 mm.	very variable.
„ diameter .....	0·06-0·07 mm.	up to 0·39 mm.
Hydrotheca, depth .....	0·29-0·37 mm.	0·80-0·84 mm.
„ diameter at mouth	0·10-0·11 mm.	0·32 mm.

*Localities.* St. 32, south-west of Domel Island, 26 to 29 fathoms, sand and mud; rare, on *Lytocarpus phæniceus*. Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; a single stem amongst the rhizoidal tubes of *Idia pristis*.

The species has hitherto been found only on the east coast of Australia, at Port Jackson (Bale, 1888, p. 765).

*Systematic position.*—While I do not find in this form characters sufficient to separate it specifically from *C. cylindrica*, it can readily be distinguished from the Australian form, examples of which I have recently had an opportunity of examining, chiefly

\* Specimens collected off New South Wales by the 'Thetis,' 1898, entrusted to me for examination.

by its dwarfish size—the diameter of the stem is only  $\frac{1}{5}$ , the length of the hydrotheca less than  $\frac{1}{2}$ , their diameter  $\frac{1}{3}$  those of typical Australian specimens (*cf.* table of dimensions given above). Var. *pusilla* is also to be distinguished by the slightly more flaring margin of its hydrotheca, and by its hyaline perisarc, for that of the robust typical variety is tinged with brown. It is possible that the discovery of their gonosomes may separate those two forms specifically.

Professor C. Hartlaub, in his fine monograph of the genus *Sertularella* (1900, p. 65), regards *S. cylindrica*, somewhat doubtfully, as a synonym of *S. integra* Allman, described from New Zealand specimens. The delicate texture of the hydrotheca is so different, however, from that of the type of *Sertularella* which bears intrathecal marginal teeth, that, apart from other obvious differences of form, sculpture, and proportion, I regard the presence of intrathecal teeth in Allman's species as sufficient, in this case, to indicate specific difference.

SERTULARELLA POLYZONIAS Linnæus, 1758.

Var. CORNUTA Ritchie (?), 1909 *b.*

A single fragmentary colony, 34 mm. high, represents this species. The hydrotheca agree in structure with typical specimens, but a single internode occasionally bears more than one hydrotheca. The habit of the colony, too, is much more definite than that of the lax variety (*gracilis*) of British seas, for from a definite, thick stem spring alternate branches almost at right angles. In this respect the specimen approaches var. *robusta* Kirchenpauer (1884, p. 38), from Cape of Good Hope, and var. *cornuta*, from the neighbourhood of the Andaman Islands. The absence of the gonosome precludes certain decision as to which variety it belongs, but the trophosome agrees in detail with that of var. *cornuta*.

Dimensions:—

Stem, diameter .....	0.63–0.70 mm.
Hydrotheca, length of adnate portion .	0.32–0.45 mm.
„ „ free „	0.28–0.39 mm.
„ greatest diameter .....	0.24–0.25 mm.
„ diameter at mouth.....	0.17–0.18 mm.

*Locality.* St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; rare.

SERTULARELLA QUADRIDENS Bale, 1884. (Plate LXXVII. figs. 12 *a*, 12 *b*.)

The transverse chitinous projections from the bases of the hydrotheca are mostly absent, and where they do occur are much less distinctly marked than in Bale's figure (pl. vii. fig. 5) of a Holborn Island specimen. The hydrotheca are strictly alternate, but the internodes are very irregular in length, from eleven to thirty-six hydrotheca occurring between successive nodes.

Considerable variation occurs also in the proximity of the hydrothecæ of the same lateral series, for while a marked gap separates some—usually on the distal portions of branches—in many cases the upper portion of one hydrotheca is pressed against the base of the next (*cf.* Pl. LXXVII. figs. 12 *a*, 12 *b*). An abnormality in the formation of the hydrothecæ is worth noting. Occasionally, probably after some accident to the branch, the hydrothecæ first formed thereafter, while normal so far as the adnate portion is concerned, have an exceptionally long portion free (0.77 mm., as contrasted with the average 0.1 mm.), this part being tubular, recurved, and having a rather indefinite margin. Its successor is less, though still abnormally large, and the diminution continues until the normal size is reached after five or six hydrotheca-pairs (text-fig. 79).

Text-fig. 79.

Abnormal hydrothecæ of *Sertularia quadridens*,  $\times 20$ .

The pinnae, each of which arises beneath a hydrotheca, are regularly alternate, three hydrothecæ being interposed between two pinnae on the same side. In one case a branch, of second degree, was observed to spring from the lumen of a hydrotheca.

The structures of the soft parts of the species, to which I have seen no reference, show points of interest. The cœnosarc of the stem is arranged in a varying number of longitudinal strands, usually three or four, which are connected irregularly by anastomosing canals, and which, with their connections, line the perisarc. In the branches the structure is less complicated. There, two large longitudinal cœnosarc tubes are to be distinguished, one running along each side of the branch, and threading its way

between the hydrotheca. These are connected at the base of each hydrotheca by a strong bridge of cœnosarc, upon the middle of which the base of the hydranth rests. These structures closely resemble those which Nutting has observed in *Selaginopsis ornata* (1904, p. 7), allowing for the differences in symmetry due to the presence of four series of hydrothecæ in that species, in place of two in this. Although each tube possesses a thick definite ectoderm, I have been unable to distinguish the perisarc which, Nutting supposes, surrounds each cœnosarcial tube.

The structure of the polyp is like that of *Thuiaria robusta*, as figured by Nutting (1904, p. 11, fig. 15). It has a large blind sac, and clumps of large endodermal cells project into the hydranth cavity except from the abcauline wall of the blind-sac, where the development of the endoderm is insignificant. The protractor band is attached, not to the abcauline wall of the hydrotheca, but to varying points of the lateral wall in the neighbourhood of the margin of the hydrotheca.

The gonosome was not observed.

Dimensions:—

Stem, diameter .....	0.56-0.77 mm.
Stem internode, length .....	2 mm.
Hydrotheca, length adnate.....	0.46-0.49 mm.
"    "    free .....	0.07-0.14 mm.
"    "    diameter at mouth .....	0.21-0.22 mm.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; several fragments. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; one colony. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock; one colony.

Previously known only from Eastern and Northern Australia; Port Curtis and Holborn Island (Bale, 1884), Peel Island, Moreton Bay (Bale, 1888), Flinders Passage, Torres Strait (Allman, 1888, as *Thuiaria vineta* \*), Thursday Island (Weltner, 1900).

#### IDIA PRISTIS Lamouroux, 1816,

One of the commonest of the species in the collection, found at eight of the fourteen stations at which Hydroids were obtained. There is much variability in the length of the free portion of the hydrotheca, the sloping operculum appearing, in some cases, to project directly from the surface of the stem, while in others a large part of the hydrotheca stands out at right angles to the stem. Occasionally, too, the adcauline operculum is lacking in definiteness, the upper wall of the hydrotheca simply meeting the lower as an indefinite flap. Many of the branches from Station 35 end in stolons, indistinguishable from those which project from the hydrorhizal tubes.

\* See Billard, 1908, p. 2 of separate copy.

*Localities.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; common. St. 14, Bushby Island pearling-ground, shore to 21 fathoms, sand and mud; common. Stt. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; common. St. 22, Hastings Harbour, shore to 20 fathoms, rock and sand; common, with gonangia, some colonies growing on a sponge. St. 23, Five Islands, 8 to 12 fathoms, rock and sand, and mud; fairly common. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells and rock; common. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; one colony. Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; common, with gonangia.

DIPHASIA DIGITALIS Busk, 1852.

In these specimens it is clearly seen that the two so-called opercular muscles are attached, not to the valves of the operculum, but to the lateral walls of the hydrotheca near the margin, and are, in function, protractor muscles (see Nutting, 1904, p. 13, fig. 17). The hydranth possesses about twenty tentacles.

*Locality.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; several small colonies, on the bare axis of an Aleyonarian, and on *Idia pristis*.

Recorded from the Western Indian Ocean—Maldive Islands—by Borradaile (1905, p. 842); this is the first record from the Eastern Indian Ocean.

SERTULARIA TURBINATA Lamouroux, 1816.

(=*S. loculosa* Busk 1852 \*.)

Several small, unbranched colonies of this species occur upon *Thyroscyphus vitiensis*. They are pale in colour, in this, as well as in the shortness of the internodes, agreeing with the specimens described from Paumben, India, by Jäderholm (1903). But they differ in the reduction of the lateral teeth, which are occasionally so indistinct that the aperture appears to be almost round. Besides an indistinct tooth on each flank, the hydrotheca is surmounted by a small third tooth, from the summit of which a membranaceous edge sometimes runs to the lateral teeth. Notwithstanding difficulties of observation, I feel assured, after examining many hydrothecæ, that the operculum is formed of a solitary flap, hinged on the distal edge of a slight thickening which occurs on the abcauline margin of the hydrotheca. Although membranes unite the superior with the lateral teeth, these do not hinge inwards, and can scarcely, therefore, be accounted part of the operculum. They are the less necessary since the abcauline flap is of diameter sufficient completely to close the aperture of the hydrotheca.

\* *Fide* Billard (1909, p. 322), who has examined the type specimen of Lamouroux.

In the structure of the operculum *S. turbinata* appears to differ from *S. verstuysii* Nutting (1904)—regarded by Billard (1908) as a synonym—for in the latter, as Congdon states (1907, p. 482), and as careful examination of the lateral aspect of specimens from Cape Verde Islands, in my collection, shows, the operculum is furnished with a large abcauline and two smaller latero-adeauline valves.

The protractor of the hydranth, which possesses only a small blind-sac, is attached to the hydrothecal wall at the intrathecal ridge.

*Localities.* Stt. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; not common.

#### Family PLUMULARIÆ.

##### PLUMULARIA SETACEA Linnaeus, 1758 (?).

A single immature colony, 15 mm. high, identical in all respects with North Sea specimens. I have written the designation with a mark of interrogation on account of the impossibility of distinguishing the trophosome of this small variety from that of *P. strictocarpa* Pietet (1893), from Amboyna.

*Locality.* Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud.

##### PLUMULARIA sp.

An unidentifiable fragment, the structures of the stem and hydroclades of which resemble those of *P. setacea*, but the fragment shows traces of branching, and the hydrotheca of having a slightly concave contour.

*Locality.* St. 32, Hastings Harbour, shore to 20 fathoms, rock and sand.

##### ANTENELLA SECUNDARIA Gmelin, 1788-93.

The nematocysts of the nematophores measure  $12\ \mu$  by  $4\ \mu$ , agreeing with Warren's measurements of those in *A. natalensis*, which I regard as a synonym. There are about 18 tentacles.

*Locality.* St. 1, east of Tavoy Island and Port Owen, 4 to 12 fathoms, sand and broken shells, and mud; not common, on *Ilia pristiis*.

##### LYTOCARPUS PENNARIUS Linnaeus, 1758.

A widely distributed species, represented by several fine colonies, one of which reached a height of 95 cm. Apart from the prominent anterior tooth, that on the margin of the hydrotheca second from the stem is distinctly the largest. It forms the highest point on the outwardly curved margin of the hydrotheca. There is, however, some variation in the prominence of



the teeth in general. The margin of the mesial sarcotheca is slightly sinuated.

The attachment of the hydroclades to stem and branches is weak, for, whenever an attempt is made to clear the specimen of flesh, by immersion in a solution of sodium hydrate, the hydroclades invariably fall off.

The soft parts of the specimens from Station 9 are well preserved, as the preservation of Plumularians in general collections goes. The tentacles are about sixteen in number. The whole of the inside of the hydrotheca, practically to the margin, is lined with a thin layer of ectoderm, with which the hydranth is in connection by means of exceedingly numerous strands which, proceeding from its ectodermal layer, give the appearance of filling the space between hydrotheca and hydranth with a delicate open meshwork. An opening leads from the hydrotheca cavity to that of the mesial sarcotheca, immediately proximal to the point where the sarcotheca joins the hydrotheca, and through this passes a strand of coenosarc, connecting sarcostyle and hydranth.

A hydrotheca was observed, abnormal in lacking a mesial sarcotheca.

*Localities.* Specimens from Stt. 9, 18, 19, 25 bore phyllaetocarps. St. 9, between Bentinck Island and Courts Island, 12 to 26 fathoms, sand and shells; one colony. St. 18, west and south-west of Paye Island, 10 to 21 fathoms, sand, shells and rock; a large colony. St. 19, Paye Island and Pink Island, 7 to 9 fathoms, rock and sand; fragment. St. 25, Gregory Group and Crichton Island, 4 to 14 fathoms, stones and broken shells, and rock; three colonies. Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; fragment.

#### LYTOCARPUS PHENICEUS Busk, 1852.

The hydrothecæ of these specimens approach most closely those of Bale's fig. 2, pl. xv., 1884, although the chitinous septa and walls are not so strongly developed in my specimens, and the small lobe at the back of the hydrotheca is not produced into a tooth. There are two sarcothecæ at the base of each hydroclade—one proximal, the other lateral—and, in addition, a sarcostyle issues through a mere perforation with raised lips, on the anterior of the stem-process on which the hydroclade is borne.

*Localities.* Stt. 15 and 16, Ravenshaw Island, Sir John Malcolm Island, and Alligator Rock, 5 to 18 fathoms, rock and sand, or rock and mud; three colonies. St. 32, south-west of Domel Island, 26 to 29 fathoms, sand and mud; one colony. St. 35, between Warden Island, Howe Island, and Lyall Island, 15 to 20 fathoms, rock and sand; one colony. Moskos Islands, 3 to 26 fathoms, rock and sand, or rock and mud; one colony.

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